

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020 SESSION

PTG 0116 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

18 OCTOBER 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages (excluding the cover page) with 4 questions and an appendix.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to **four** significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all relevant steps to obtain maximum marks.

Question 1

*A list of trigonometric identities are provided in the appendix.

- (a) Perform the following without using the conversion function in a calculator. Show the relevant steps in your conversion.
- (i) Convert 89.9841° to $D^\circ M' S''$ form. Round your answer to the nearest second. [3 marks]
 - (ii) Convert $56^\circ 43' 33''$ to decimal degrees. Round your answer to three decimal places. [3 marks]
 - (iii) Convert 201.5° to radians. Round your answer to three decimal places. [2 marks]
- (b) Let $\sin \beta = -\frac{1}{4}$ and $\tan \beta > 0$.
- (i) State which quadrant β is in. [1 mark]
 - (ii) Use trigonometric identities to find the exact values of $\csc \beta$, $\cos \beta$, $\sec \beta$, $\tan \beta$ and $\cot \beta$. [5 marks]
- (c) Establish the following identities. If you use any existing trigonometric identities in your proof, write them explicitly beside your working. [6 marks]
- (i) $\tan \theta \cot \theta - \sin^2 \theta = \cos^2 \theta$
 - (ii) $\frac{1 - \sin \theta}{\sec \theta} = \frac{\cos^3 \theta}{1 + \sin \theta}$
- (d) Solve $\tan^2 \left(2\theta + \frac{\pi}{2} \right) = 2$ for $0 \leq \theta < \frac{\pi}{2}$. [5 marks]

Question 2

- (a) Let $a = -2 - 4i$ and $b = -3 + 12i$. Find
- (i) $-3\bar{a} + 5\bar{b}$, [3 marks]
 - (ii) $\frac{b}{a}$. [4 marks]
- Express your answers in standard form.
- (b) Convert the rectangular coordinates $(-\sqrt{3}, 2)$ to polar coordinates. Hence, write $-\sqrt{3} + 2i$ in polar form. [4 marks]
- (c) Show that $\sin^2 \theta + \cos \theta = 2$ in rectangular form is $3x^4 + y^4 + 3x^2 y^2 = 0$. [3 marks]
- (d) Given $A(3, 2, 10)$ and $B(-4, 5, -1)$, find
- (i) \overrightarrow{BA} , [2 marks]
 - (ii) the coordinates of the point whose position vector equals \overrightarrow{BA} . [1 mark]

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- (e) Given $\underline{a} = \langle -2, 5, 3 \rangle$ and $\underline{b} = \langle 5, 3, -2 \rangle$, find
- (i) the unit vectors that are orthogonal to both \underline{a} and \underline{b} , [5 marks]
 - (ii) $|2\underline{a} - \underline{b}|$. [3 marks]

Question 3

- (a) A circle is described by $x^2 + y^2 - 16x - 10y + 40 = 0$.
- (i) Find the centre and radius of the circle. [4 marks]
 - (ii) Find the coordinates of the points on the circle with $x = 9$. [3 marks]
 - (iii) Using one of the points in (a)(ii), find an equation of the circle's diameter in slope-intercept form. [3 marks]
- (b) An ellipse is described by the equation $2x^2 + 3y^2 + 68x + 60y + 872 = 0$.
- (i) Give a definition of an ellipse in words. [1 mark]
 - (ii) Rearrange the equation such that it is in standard form. [4 marks]
 - (iii) Sketch the ellipse. Label the foci, vertices and centre, and give their coordinates. [7 marks]
- (c) Determine whether the following lines are perpendicular. [3 marks]
- $$2x + 5y - 25 = 0$$
- $$5x + 2y - 10 = 0$$

Question 4

- (a) Solve the following system of linear equations for x and y only. Use Cramer's rule.
- $$x + 2y + 2z = -2$$
- $$3z - 4y - x = -19$$
- $$5y - 4z + 6x = 15$$
- [13 marks]
- (b) Find A^{-1} if $A = \begin{bmatrix} 1 & 2 & -1 \\ 4 & 3 & 6 \\ -5 & 8 & 5 \end{bmatrix}$. [12 marks]

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APPENDIX

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\tan^2 \theta + 1 = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A - B) = \cos A \cos B + \sin A \sin B$$

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A - B) = \sin A \cos B - \cos A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

$$\sin^2 A = \frac{1 - \cos 2A}{2}$$

$$\cos^2 A = \frac{1 + \cos 2A}{2}$$

$$\tan^2 A = \frac{1 - \cos 2A}{1 + \cos 2A}$$

$$\tan A = \frac{\sin 2A}{1 + \cos 2A}$$

$$= \frac{1 - \cos 2A}{\sin 2A}$$

$$\sin A \cos B = \frac{1}{2} [\sin(A - B) + \sin(A + B)]$$

$$\cos A \cos B = \frac{1}{2} [\cos(A - B) + \cos(A + B)]$$

$$\sin A \sin B = \frac{1}{2} [\cos(A - B) - \cos(A + B)]$$

$$\sin A + \sin B = 2 \sin \frac{A+B}{2} \cos \frac{A-B}{2}$$

$$\sin A - \sin B = 2 \cos \frac{A+B}{2} \sin \frac{A-B}{2}$$

$$\cos A + \cos B = 2 \cos \frac{A+B}{2} \cos \frac{A-B}{2}$$

$$\cos A - \cos B = -2 \sin \frac{A+B}{2} \sin \frac{A-B}{2}$$

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